

Faculty of Design

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Saving lives, by design: Using systems thinking To combat maternal mortality In India

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SAVING LIVES, BY DESIGN

SYSTEMS THINKING TO ADDRESS MATERNAL DEATH IN INDIA

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2009

**JHPIEGO &
Johns
Hopkins
University
win a
significant
financial
grant on
Saving Lives
at Birth**



USAID
FROM THE AMERICAN PEOPLE





RESEARCH

understanding the context

WHAT IS MATERNAL MORTALITY?

Pregnancy-related death is defined as the death of a woman while pregnant or within

42 days

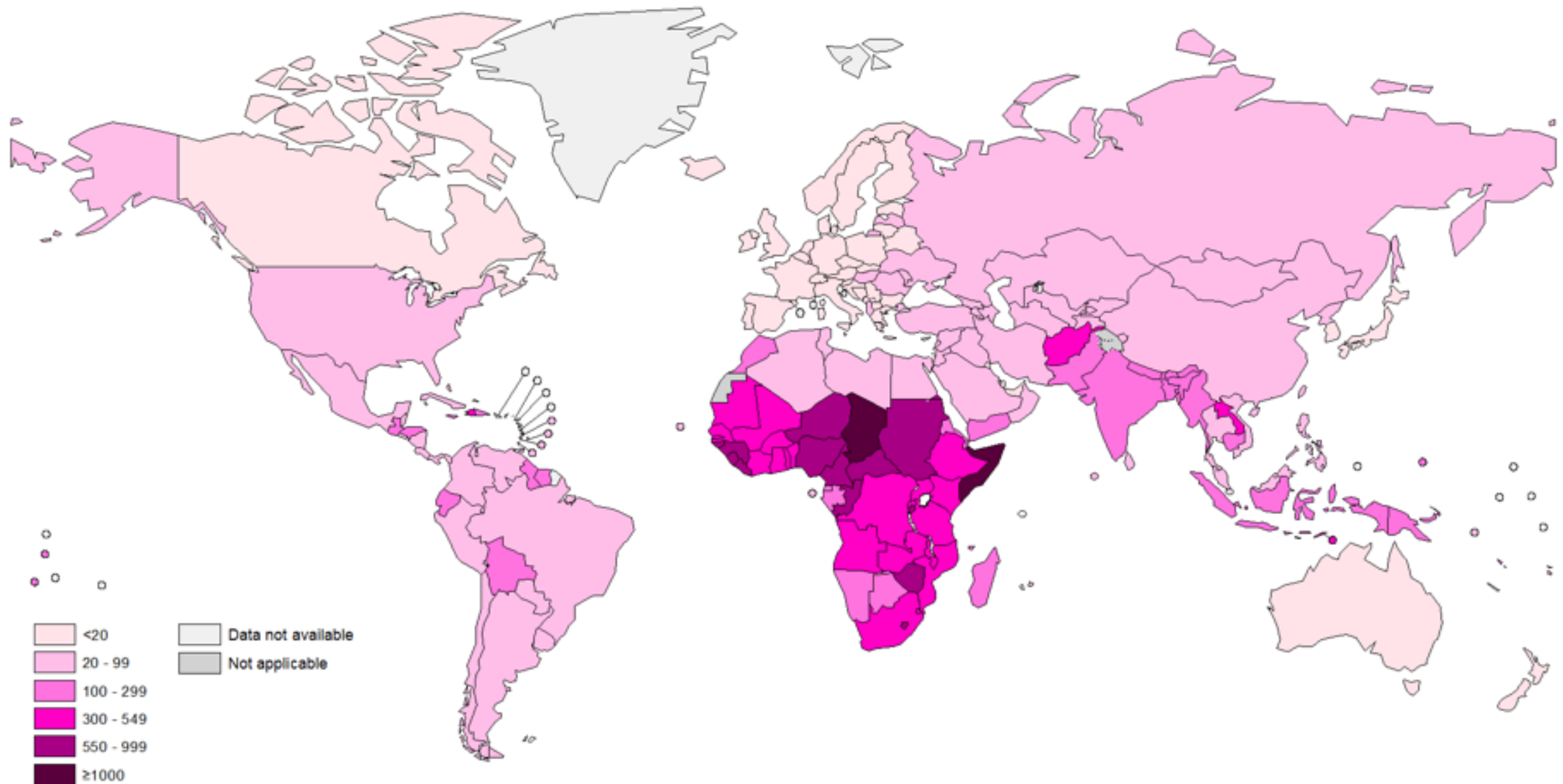
of termination of pregnancy, irrespective of the cause of death.





A burning issue in the developing world

Maternal mortality ratio (per 100 000 live births), 2010



The boundaries and names shown and the designations used on this map do not imply the expression of any opinion whatsoever on the part of the World Health Organization concerning the legal status of any country, territory, city or area or of its authorities, or concerning the delimitation of its frontiers or boundaries. Dotted and dashed lines on maps represent approximate border lines for which there may not yet be full agreement.

Data Source: World Health Organization
Map Production: Public Health Information
and Geographic Information Systems (GIS)
World Health Organization



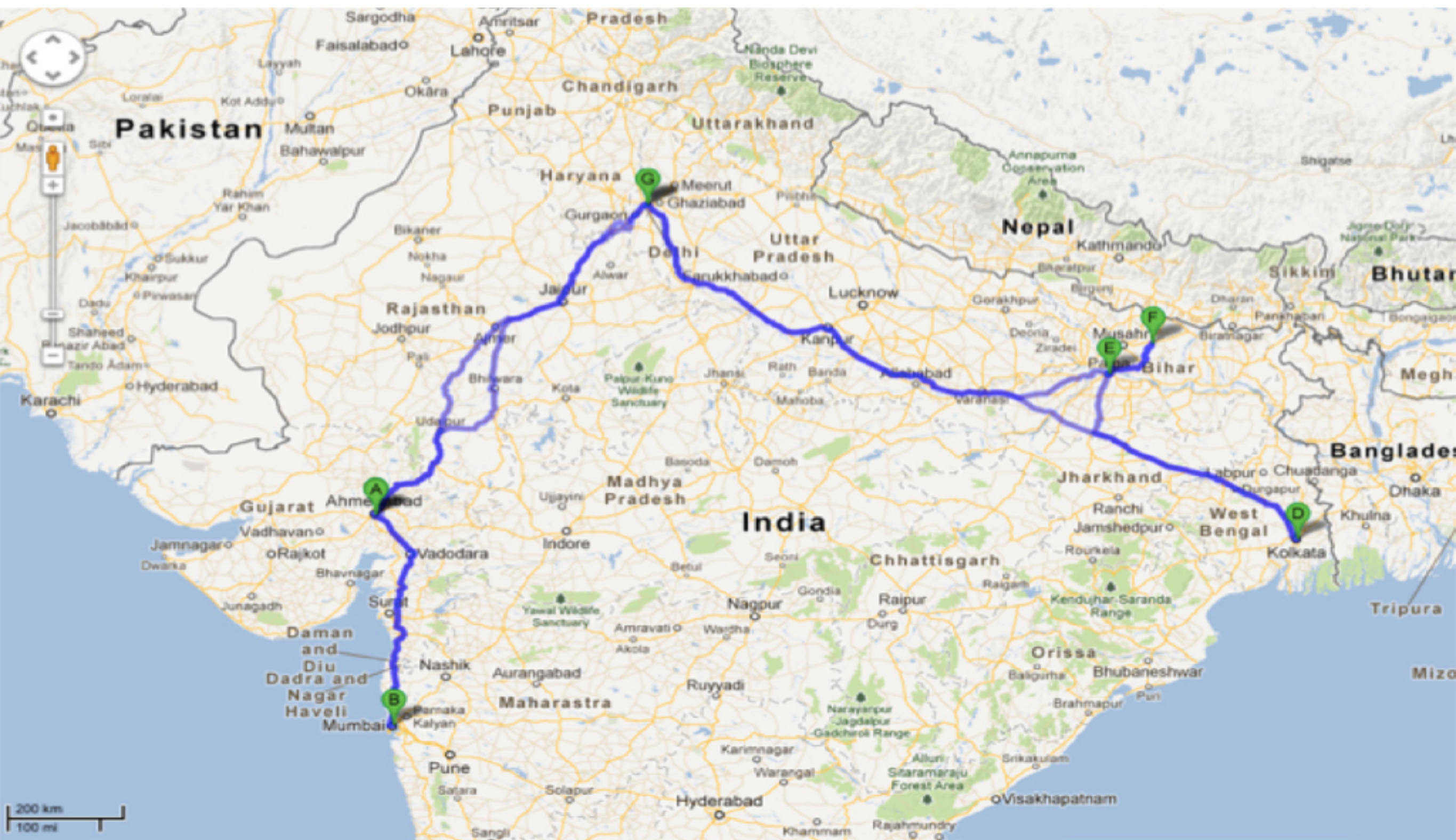
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MOTHER'S DEATH - DISINTEGRATION OF THE FAMILY STRUCTURE



CLINICAL IMMERSION

journey into the void





Johnson & Johnson, Mumbai



Lilavati Hospital, Mumbai



All India Institute of Medical Sciences AIIMS, New Delhi



Calcutta Medical College - 200 deaths in a week!







जय प्रभा जननी-शिशु आरोग्य एक्सप्रेस

बिहार सरकार

राज्य स्वास्थ्य समिति द्वारा अनुश्रवित

बेसिक जीवन रक्षक एम्बुलेंस

जिला स्वास्थ्य समिति, दरभंगा

प्रथम रेफरल इकाई (FRU), रेफरल अस्पताल, जाले

AMBULANCE ACCESS FOR ALL

EMERGENCY

DIAL

102

















3 countries

29 days of travel

4000 km covered in India, Kenya, Nepal

7 cities

11 villages

8 months of work

+

45 midwives

23 doctors

19 doctors in residency

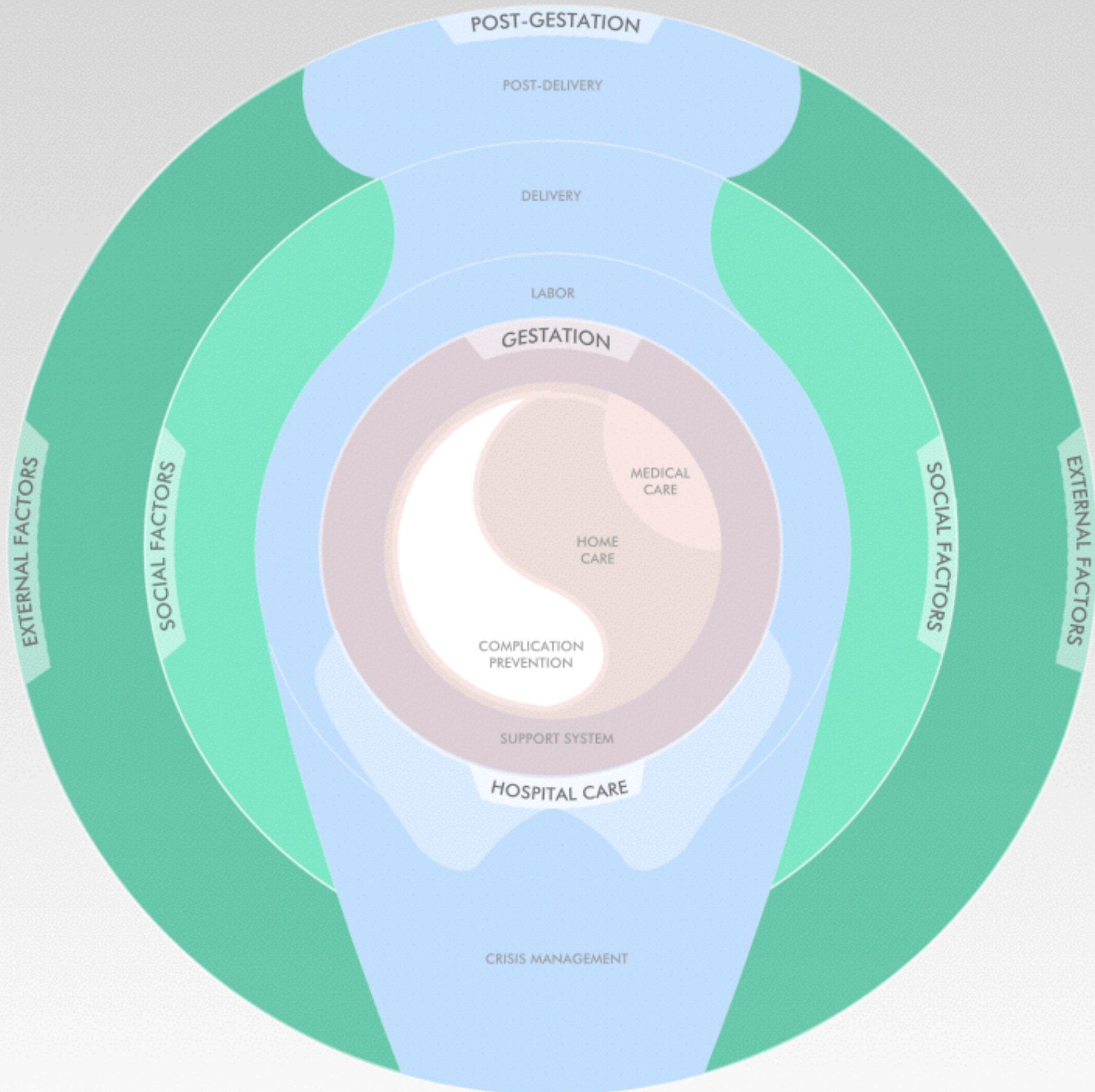
8 medical experts

6 public health experts

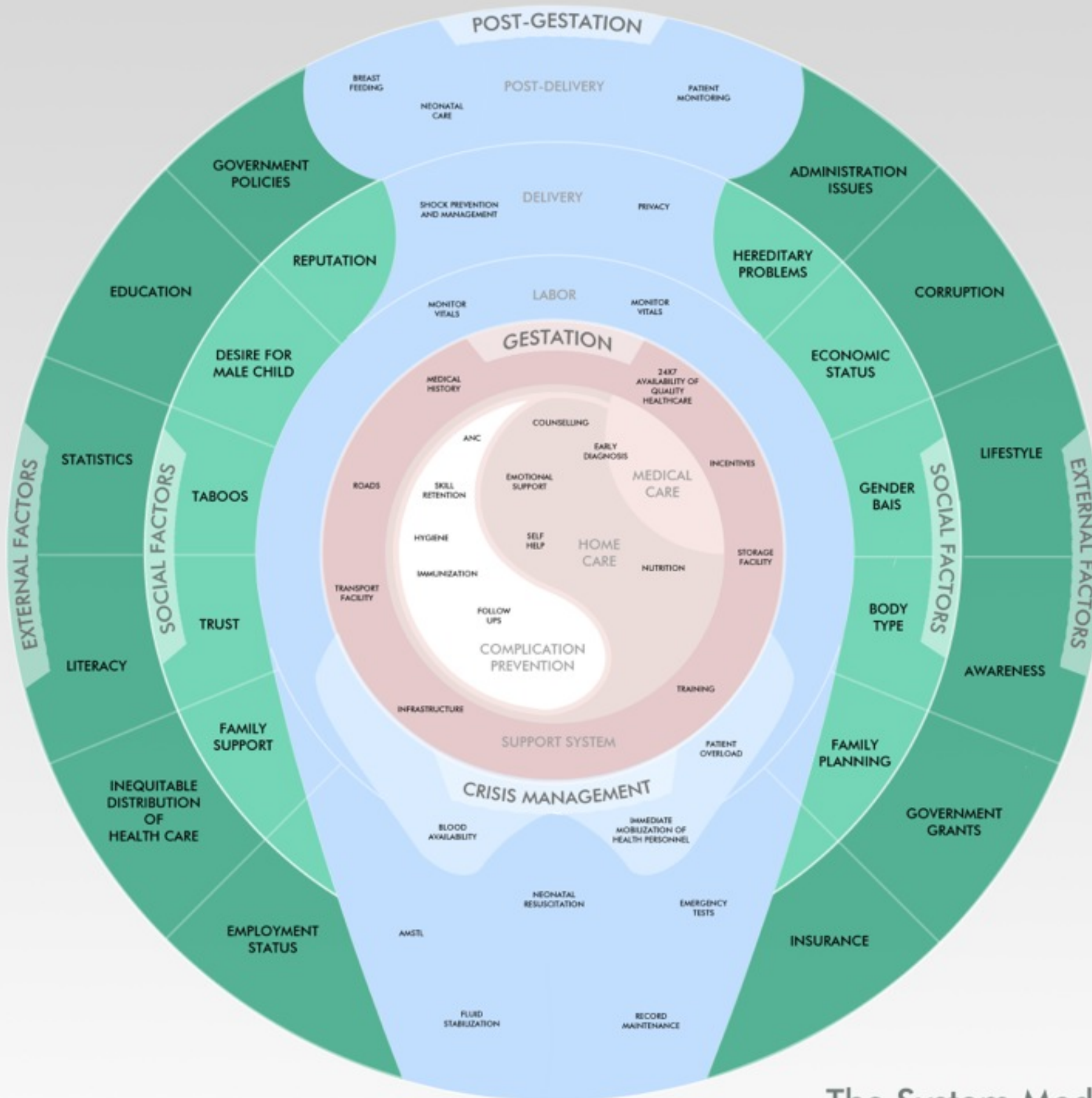
300+
pages of data

MAKING SENSE OF THE DATA
mapping systemic relationships

**Can the systems model be
a visual metaphor of the
child in the womb?**







The System Model

Identification of 3 leverage points in the system

Maternal Anaemia: Before the pregnancy

Pre Eclampsia: During pregnancy

Post Partum Haemorrhage: After birth

IDEA GENERATION > BUCKET LIST

POSTPARTUM HAEMORRHAGE



**KEY QUESTION - HOW CAN WE
PREVENT WOMEN IN DEVELOPING
NATIONS FROM BLEEDING TO DEATH?**

IDEATION WITH DOCTORS, MIDWIVES, BIOMEDICAL ENGINEERS & DESIGNERS



Doctors like medical solutions
Engineers like technology
Public health experts love policy
&
Designers make emotional decisions !

**Can we find a logical way of identifying
true inflection points in the system?**

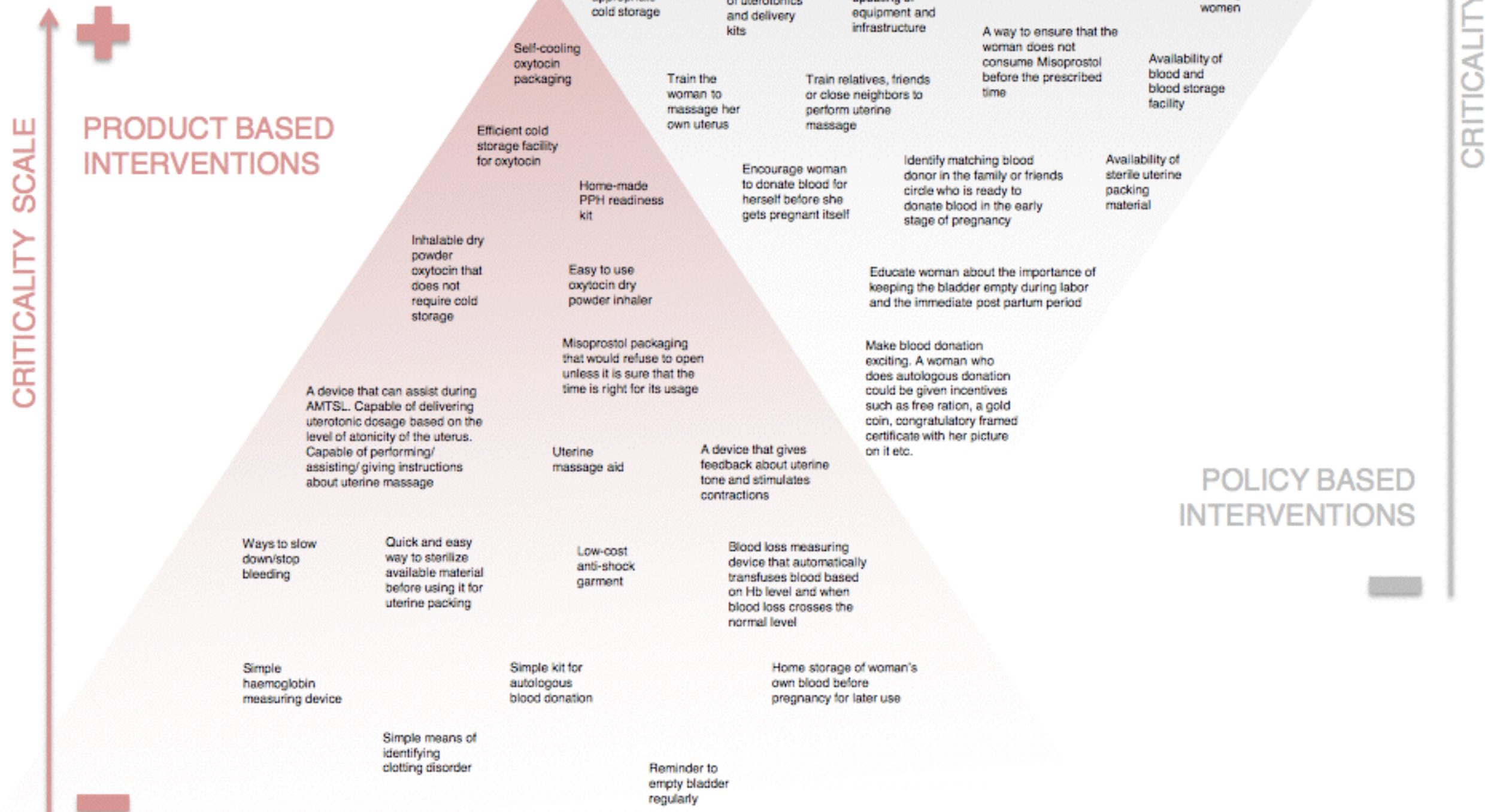
**We identified over 100 opportunities
or issues to be tackled...**

**But how do we sort
the issues according to amount of impact?**

Generation of solutions and categorization based on criticality in the system



Generation of solutions and categorization based on criticality in the system

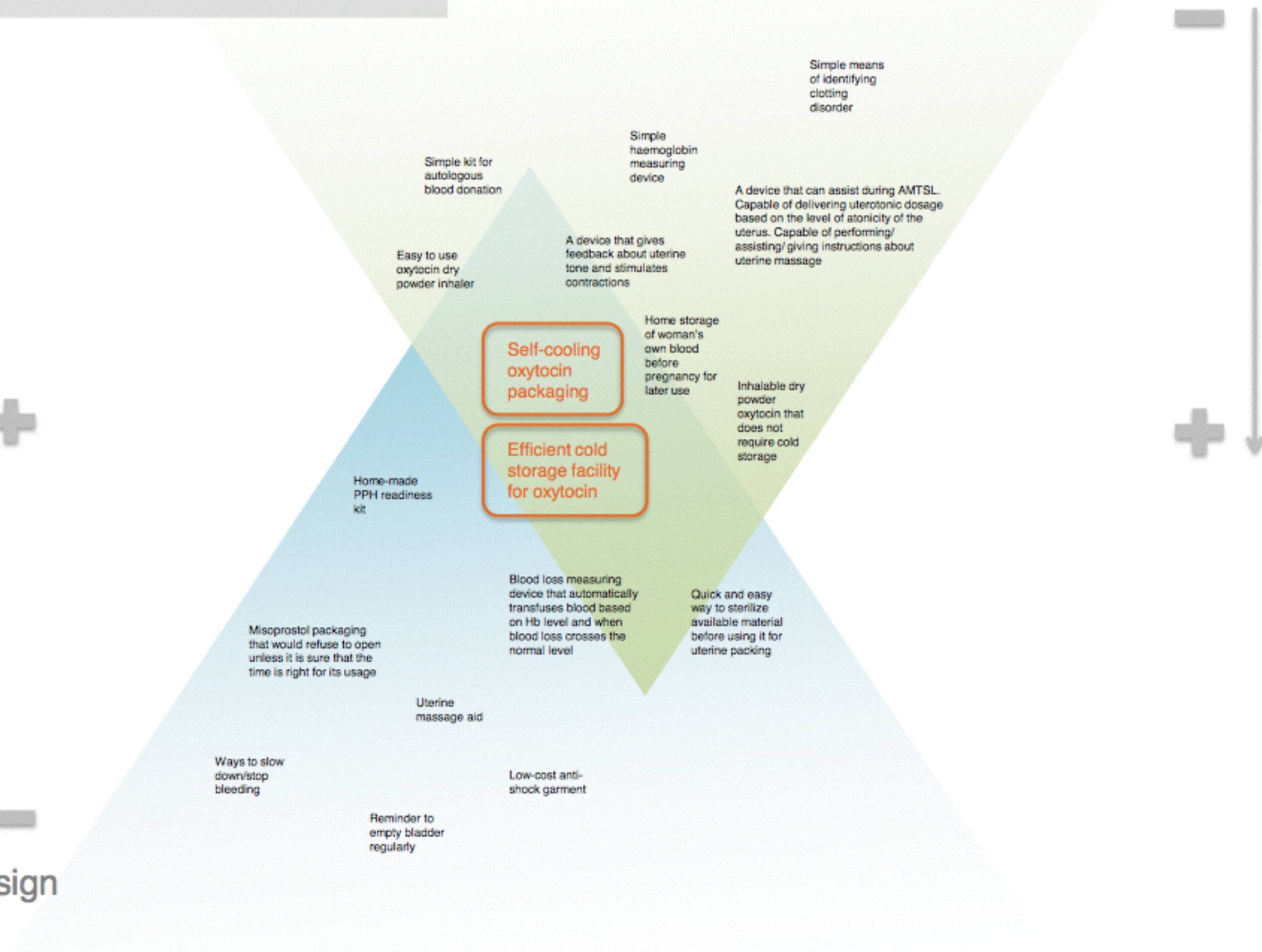


Product-based interventions

Engineering



Design



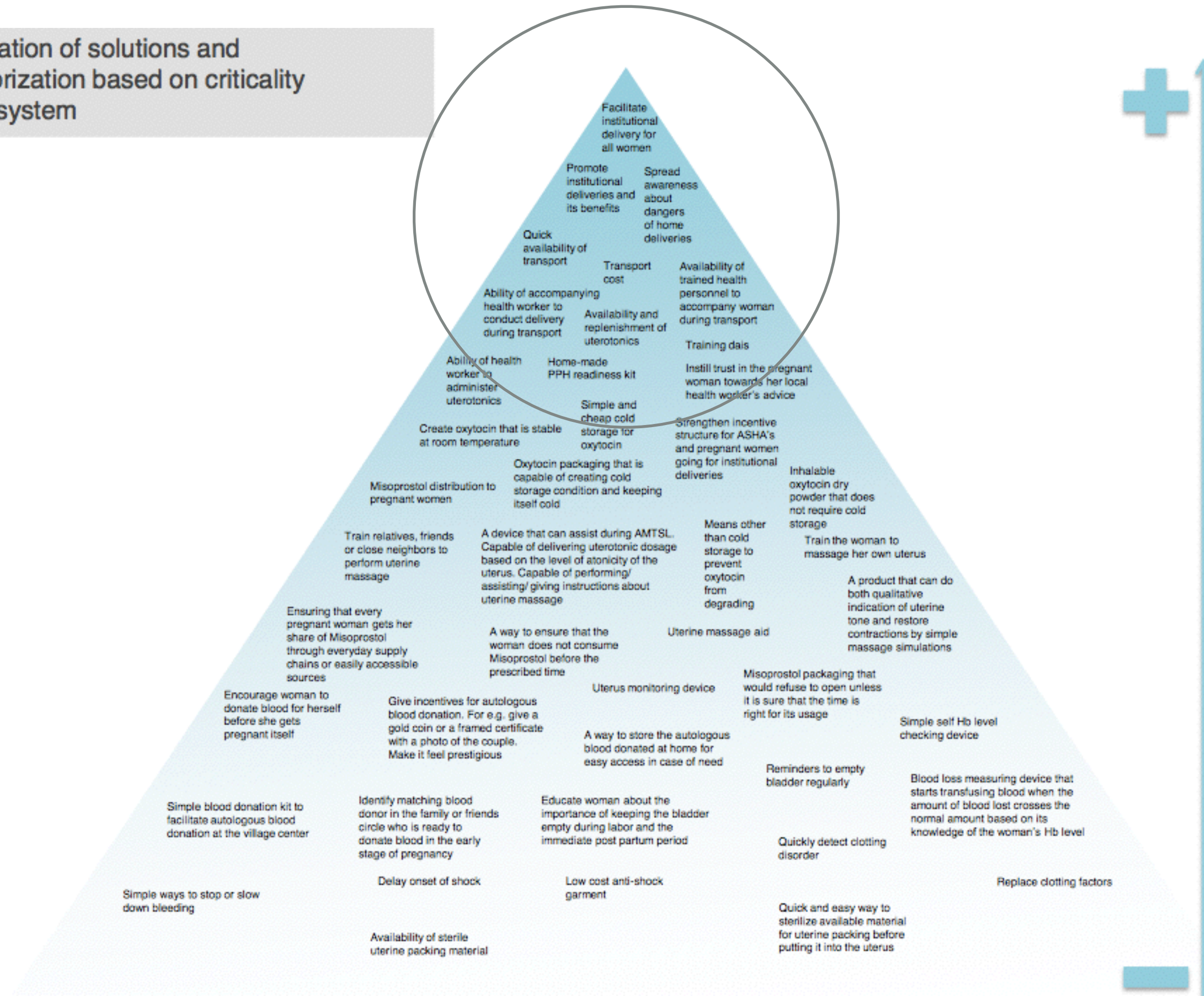
DESIGNING SOLUTIONS

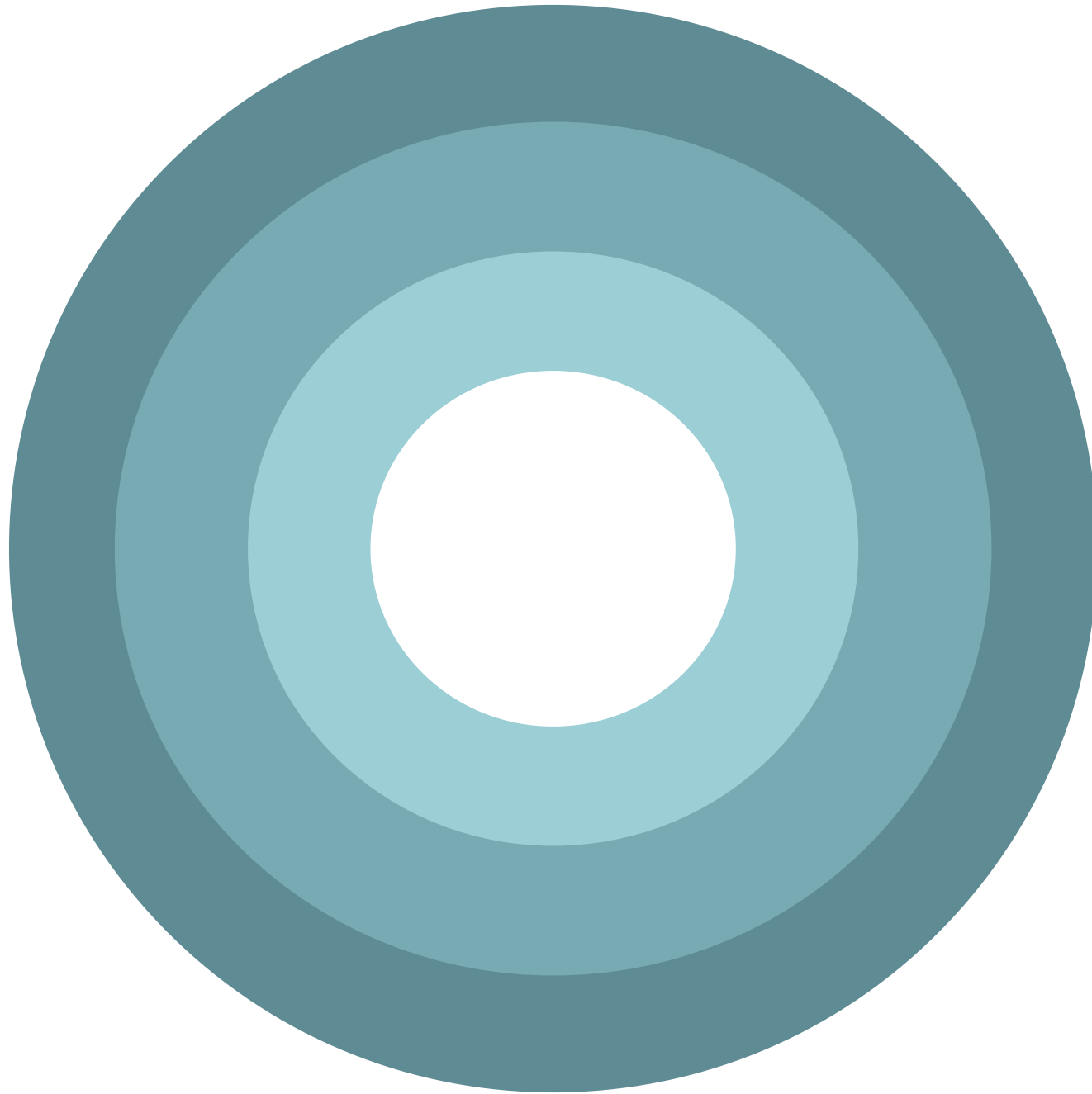
POST PARTUM HAEMORRHAGE



**KEY QUESTION - HOW CAN WE
PREVENT WOMEN FROM BLEEDING
TO DEATH?**

Generation of solutions and categorization based on criticality in the system



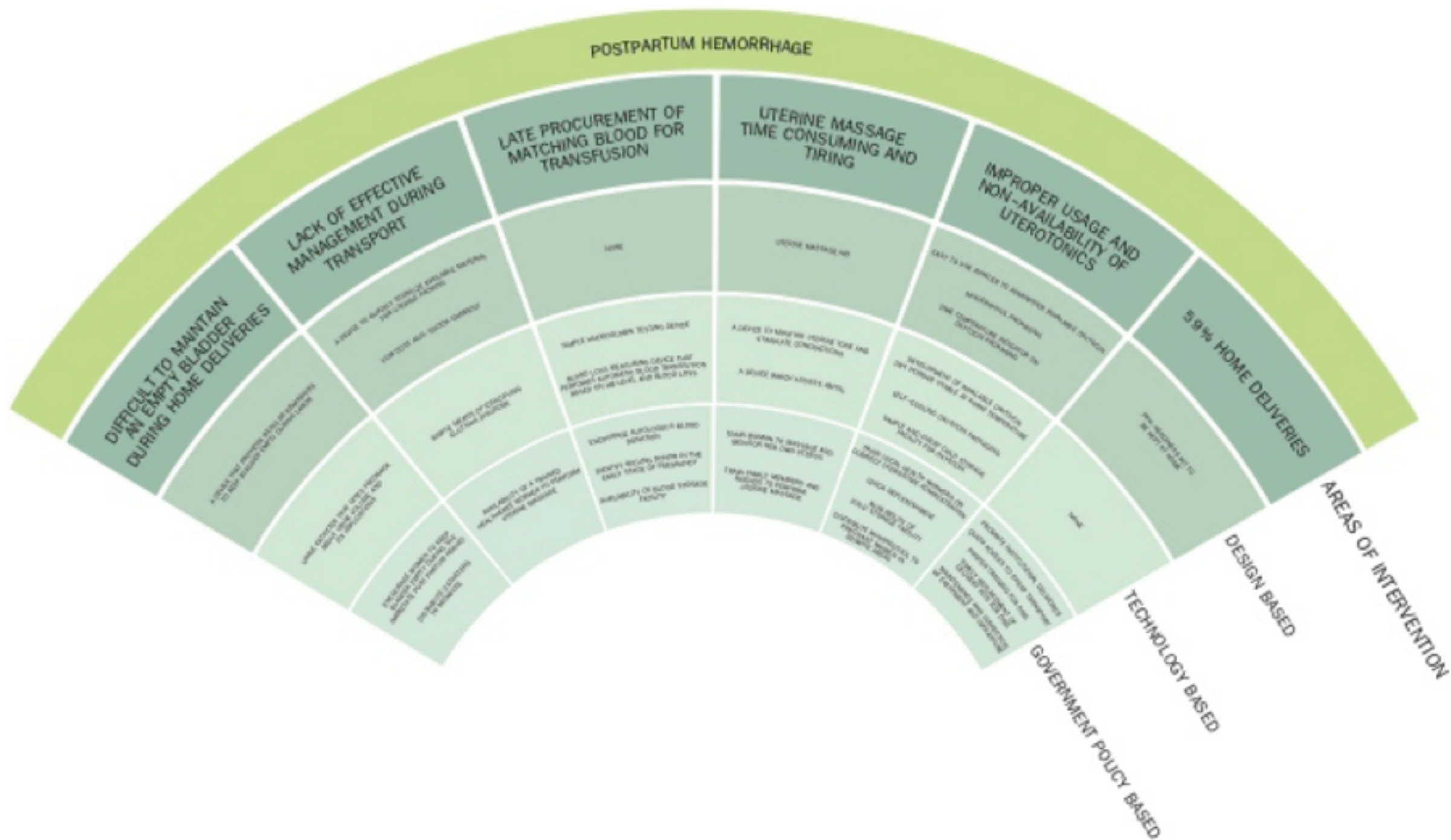


Technology based interventions
Design based interventions
Policy based interventions

Three facets of the solution matrix



ISSUES FACED	Prevailing statistic of 59% home deliveries happening in India	Improper usage and non-availability of effective uterotonics	Uterine massage not performed since it is time consuming and tiring	Late procurement or inability to procure matching blood for transfusion	Lack of effective management of haemorrhage during transport	Difficult to ensure that the bladder is kept empty during home deliveries
Design intervention	<p>Home-made PPH readiness kit which could include-</p> <ul style="list-style-type: none"> Sterilized cloth pieces to be used for uterine packing Simple battery operate sterilizer for available materials such as old cloth etc. that could be used for uterine packing Simple substitute for the NASG (Non-pneumatic anti shock garment) Misoprostol tablets Commonly available household product which could be used as a uterine massage aid 	<ul style="list-style-type: none"> Low cost, easy to use inhaler to administer inhalable oxytocin developed by researchers in Australia Misoprostol packaging that would open only when the time is right for its usage Time temperature indicator (TTI) on oxytocin packaging to indicate whether oxytocin is still active 	<ul style="list-style-type: none"> Uterine massage aid 		<ul style="list-style-type: none"> Quick and easy way to sterilize available material before using it for uterine packing Low cost anti-shock garment 	<ul style="list-style-type: none"> A product that gives regular reminders to empty bladder
Engineering intervention		<ul style="list-style-type: none"> Development of inhalable oxytocin dry powder which does not require cold storage by researchers in Australia Self-cooling oxytocin packaging Efficient cold storage facility for oxytocin 	<ul style="list-style-type: none"> A device that gives feedback about uterine tone and stimulates contractions A device that can assist during AMTSL. Capable of delivering uterotonic dosage based on the level of atonicity of the uterus. Capable of performing/ assisting/ giving instructions about uterine massage 	<ul style="list-style-type: none"> Simple kit for autologous blood donation and storage at home itself Simple haemoglobin testing device Blood loss measuring device that automatically transfuses blood based on Hb level and when blood loss crosses the normal level 	<ul style="list-style-type: none"> Simple means of identifying clotting disorder 	<ul style="list-style-type: none"> Automatic urine catheter which gives feedback about urine volume and its implications
Intervention through Government policies for human resource development	<ul style="list-style-type: none"> Strengthen incentive structure for ASHA's and pregnant women going for institutional deliveries Instill trust in the pregnant woman towards her local health worker's advice Proper training for Dais 	<ul style="list-style-type: none"> Train health workers on how to administer uterotonics 	<ul style="list-style-type: none"> Teach the woman to massage and monitor her own uterus Train close relatives, friends or neighbors to perform uterine massage 	<ul style="list-style-type: none"> Identify a willing blood donor among family or friends in the early stage of pregnancy itself Encourage woman to do autologous blood donation before she gets pregnant or even before she gets married A woman who does autologous donation could be given incentives such as free ration, a gold coin, congratulatory framed certificate with her photo on it etc. 	<ul style="list-style-type: none"> Availability of a trained health worker who can perform uterine massage 	<ul style="list-style-type: none"> Educate the woman to keep her bladder empty during labor and immediate post partum period
Intervention through Government policies concerning other resources	<ul style="list-style-type: none"> Regular inspection and updating of equipment and infrastructure Provide dais with delivery kits and ensure timely replacement before stocks run out Provide quick access to transport and reduce the cost of the same for pregnant women Promote institutional deliveries and their benefits Spread awareness about the dangers of home deliveries and promote institutional deliveries and their benefits 	<ul style="list-style-type: none"> Quick replenishment of uterotonics Availability of low cost & low maintenance cold storage Distribute misoprostol to all pregnant women 		<ul style="list-style-type: none"> Availability of blood storage facility 		<ul style="list-style-type: none"> Distribute catheters to midwives



Post Partum Haemorrhage (PPH)

What makes this fatal

Oxytocin when exposed to high temperatures **loses its potency** and becomes useless to treat or prevent PPH while giving a **false sense of security**.

A nurse in Jalee Referral Hospital, showing us the drug storage cabinet.



Each ampoule contains:
Oxytocin IP (Synthetic) eq. to
5 unit of Oxytocin activity per ml.
Store between 8° to 25°C.
DO NOT FREEZE.

'SCHEDULE H DRUG. Warning :
To be sold by retail on the
prescription of a Registered
Medical Practitioner only.'

Detailed Design Brief

Functional aspects

- Ensure that oxytocin is always available only contained within the cooling unit to ensure temperature regulated storage.
- Store 100 ampoules of oxytocin.
- Self-sustaining.
- Does not require electricity.
- Low maintenance.
- Eliminate the need to open the container too often.

Technical aspects

- Super insulation technique employed for cooling.
- Good cold retention or heat repelling properties.
- Dispensing mechanism to dispense one ampoule at a time.
- A cold life of at least 2 months.
- Display screen on the container.
- Display the internal and external temperature.
- Display number of ampoules remaining on the same screen. Or provide a printed roll of numbers like in an analog camera. With each push of the dispensing button, the number visible on the roll would decrease by one.
- Batteries would be required to power the display screen.
- The screen can be eliminated by using an external thermometer to test performance.
- Visual reminders to order for a refilled container when the number of ampoules reduces to a minimum number.
- Visual prompt to take necessary action in case the internal temperature rises above acceptable levels.

Usability

- The dispenser should dispense one ampoule with the user having to exert just a minimum amount of pressure on the dispensing button.
- The ampoule must be dispensed as soon as the button is pushed. There must be no delay or waiting period.
- The dispensing button must be fail-proof.
- The form and positioning of the dispensing button must be such that the user intuitively understands its purpose and usage.
- The display screen should be easy to read and understand.

Ergonomics and Aesthetics

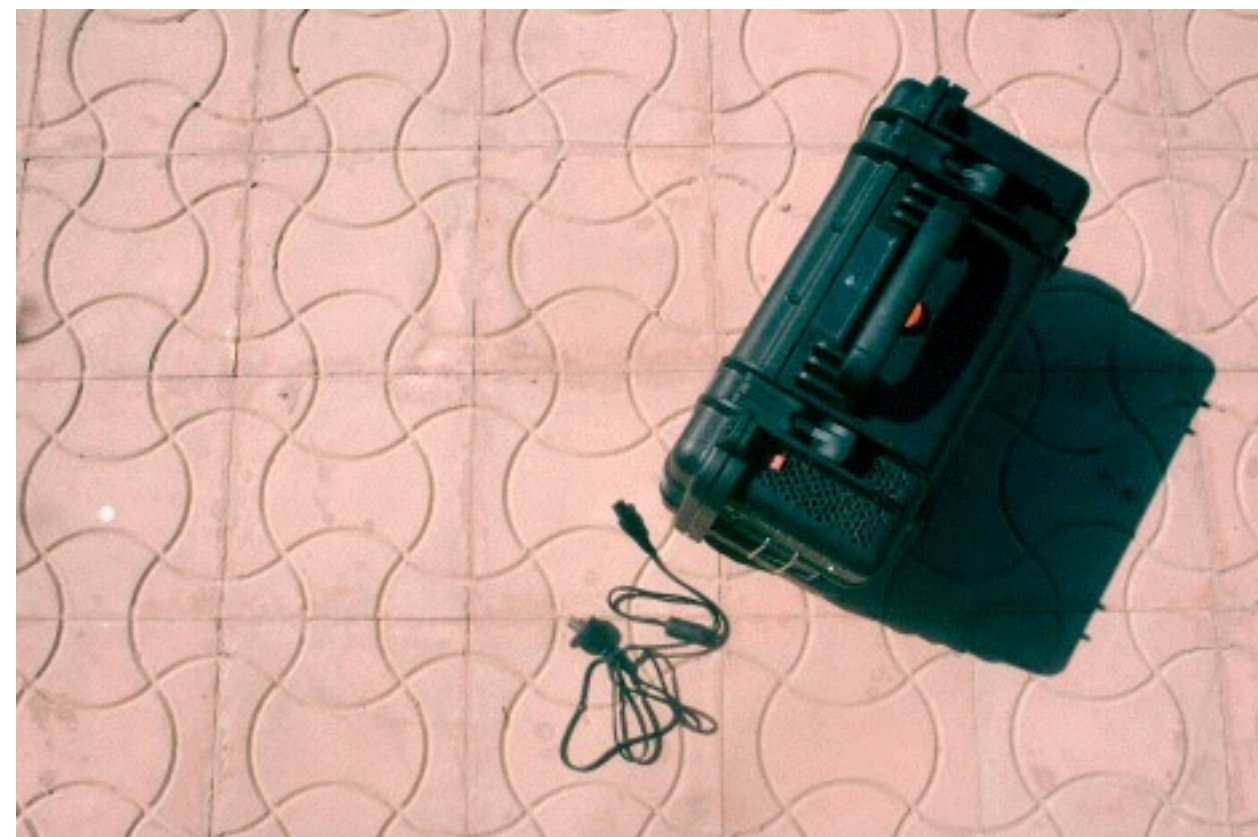
- The opening from which the dispensed ampoule is retrieved should be big enough to allow 95th percentile fingers of the combined male-female user group to comfortably remove the ampoule.
- Project effectiveness and reliability.
- Reflect the serious nature of its purpose and place of usage.

Supply

- Oxytocin ampoules must be supplied only as contained within the storage unit and not lose.
- When one storage unit runs out of ampoules, a backup unit is used while waiting for a replacement unit.
- The empty unit would be replaced with a refilled one.



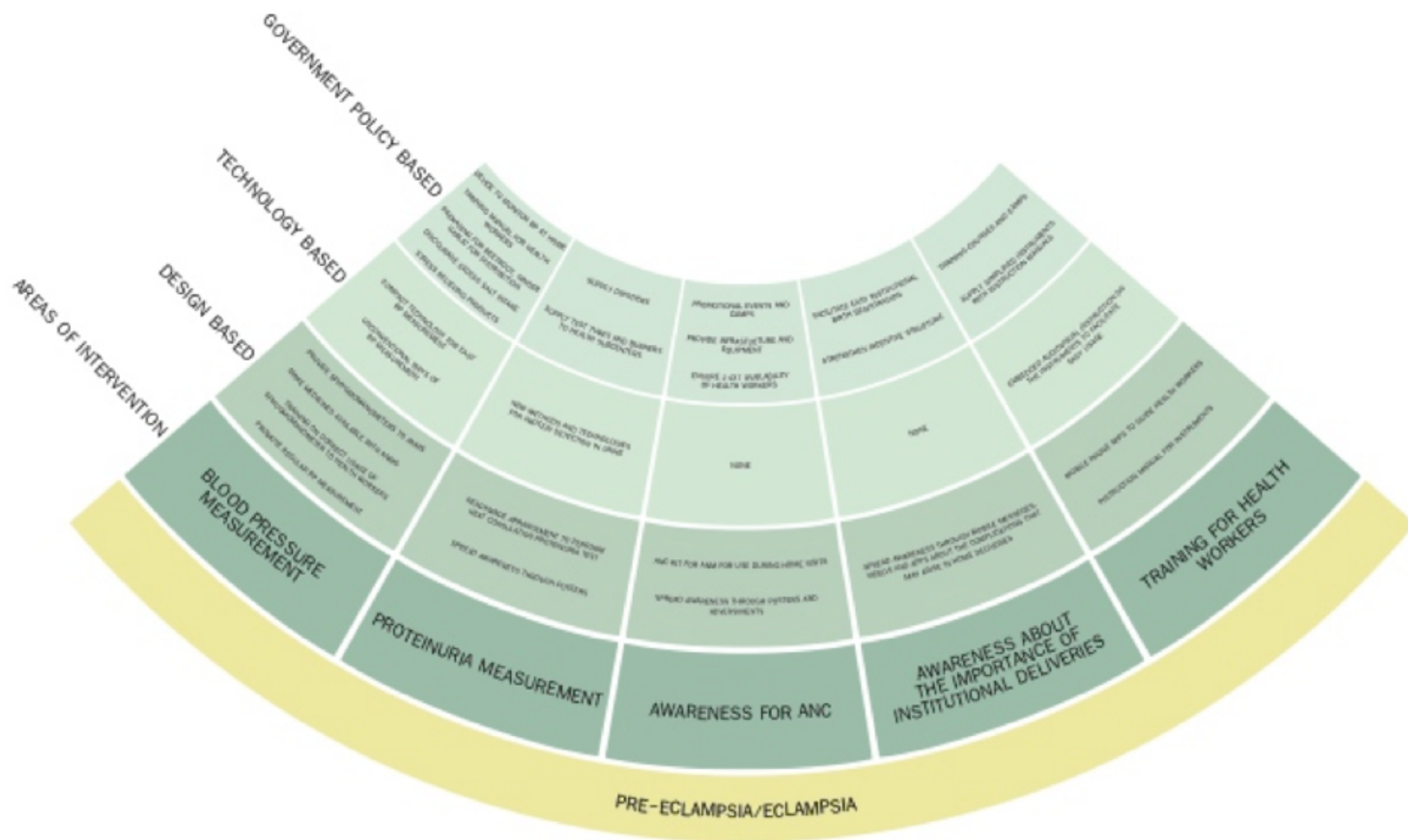
LOW COST BATTERY
POWERED OXYTOCIN
COOLER FOR DEEP RURAL
LAST MILE CONNECTIVITY



PRE ECLAMPSIA



**KEY QUESTION - HOW CAN WE
DETECT RISING BLOOD PRESSURE
BEFORE IT GETS CRITICAL?**





**Protein urea
detected by dipsticks**

**Dipsticks are
not available!**

LOW COST DEVICE
TO DETECT
PROTEIN UREA IN
URINE, CARRIED BY
RURAL HEALTH
WORKERS,
DETECTS UREA
WITHIN 60
SECONDS

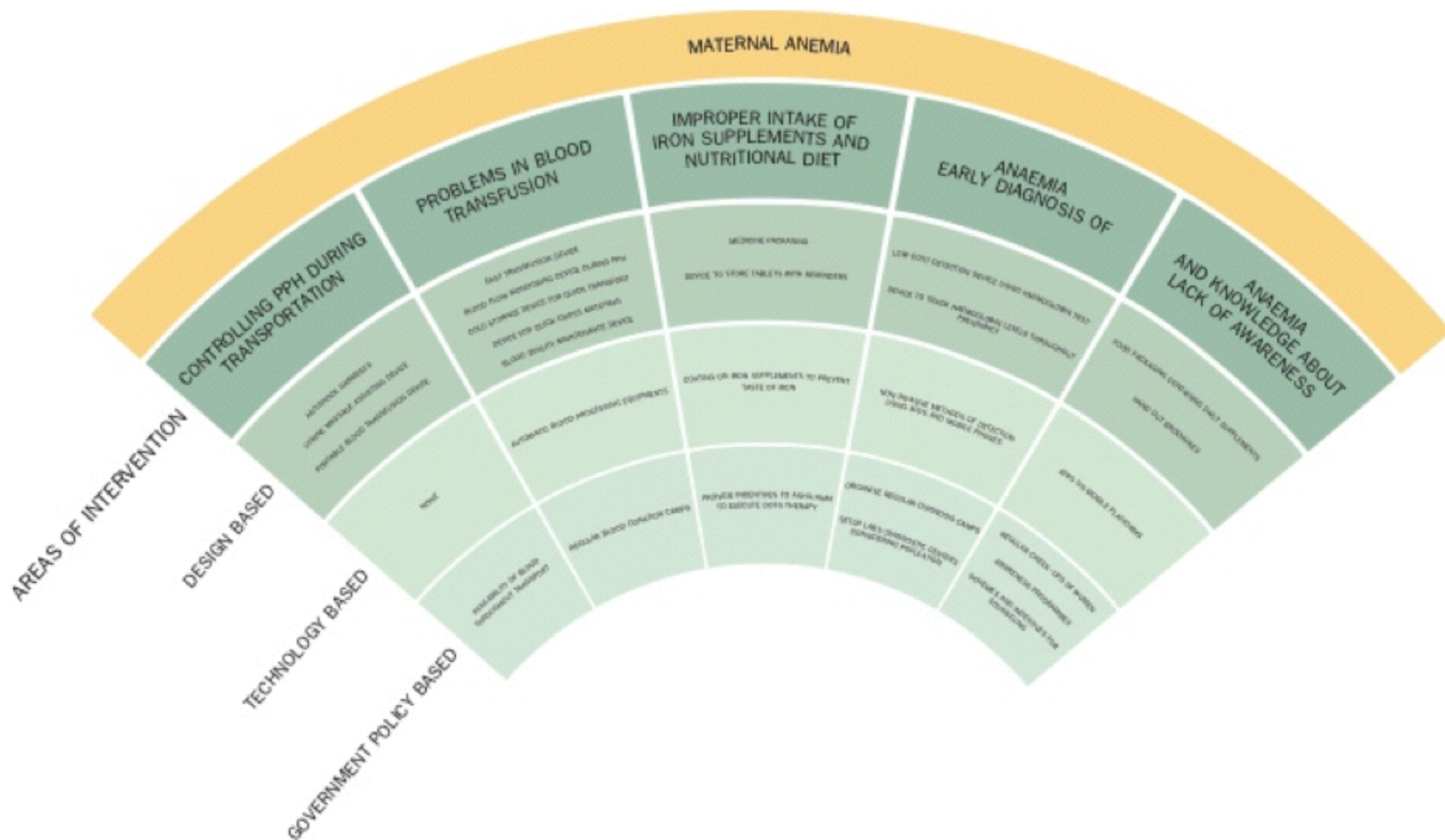


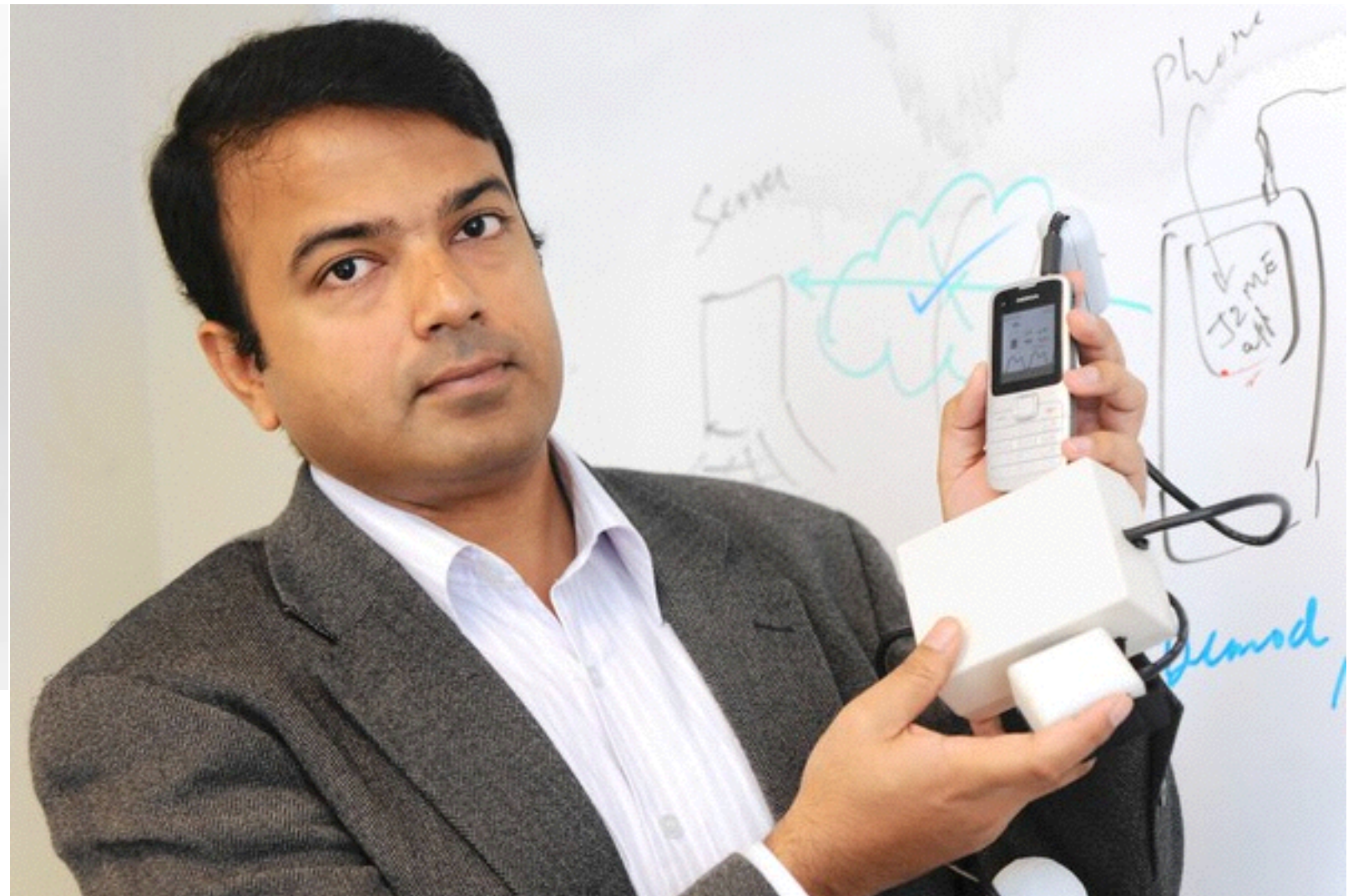


MATERNAL ANAEMIA



**KEY QUESTION - HOW CAN WE
DETECT ANAEMIA BEFORE IT IS TOO
LATE?**





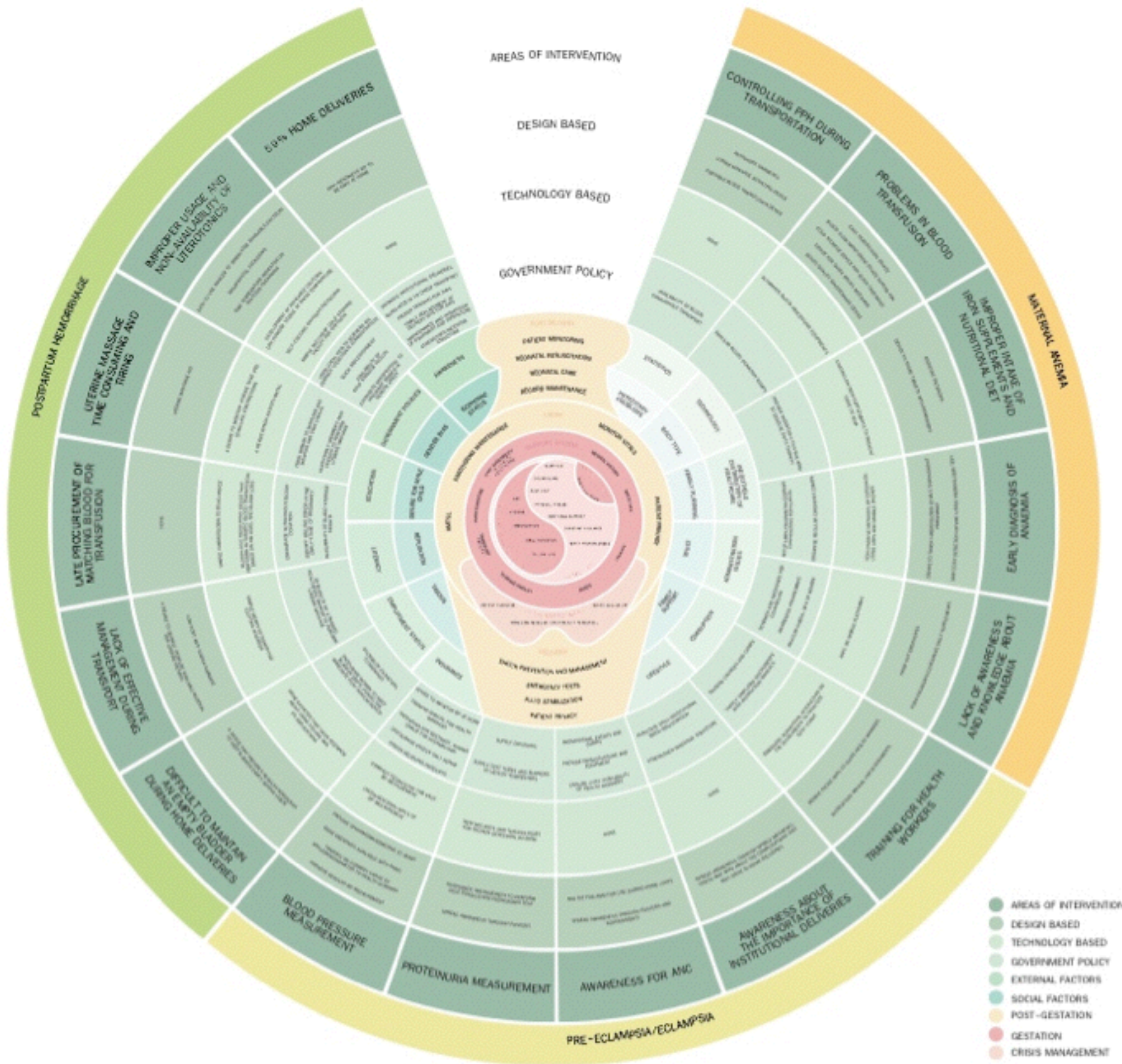
LOW COST
ANAEMIA
DETECTOR,
POWERED BY A
SIMPLE PHONE,
OPERABLE WITH
NO CLINICAL
TRAINING



Using the systems model,
we were able to generate over

100

opportunities for intervention
for addressing mortality spread over
design, technology, services, policy & human resources domains



50 YEARS
AMNESTY
INTERNATIONAL



EVERY 90 SECONDS
A WOMAN DIES FROM
COMPLICATIONS OF
CHILDBIRTH.

WE CAN CHANGE THAT.

DEMAND DIGNITY DEMAND DIGNITY



DEMAND DIGNITY



DEMAND DIGNITY

DEMAND DIGNITY

DEMAND DIGNITY

DEMAND



Thanks for your patience!

SAVING LIVES, BY DESIGN
RSD3 Systemic Design Symposium, Oslo, Norway